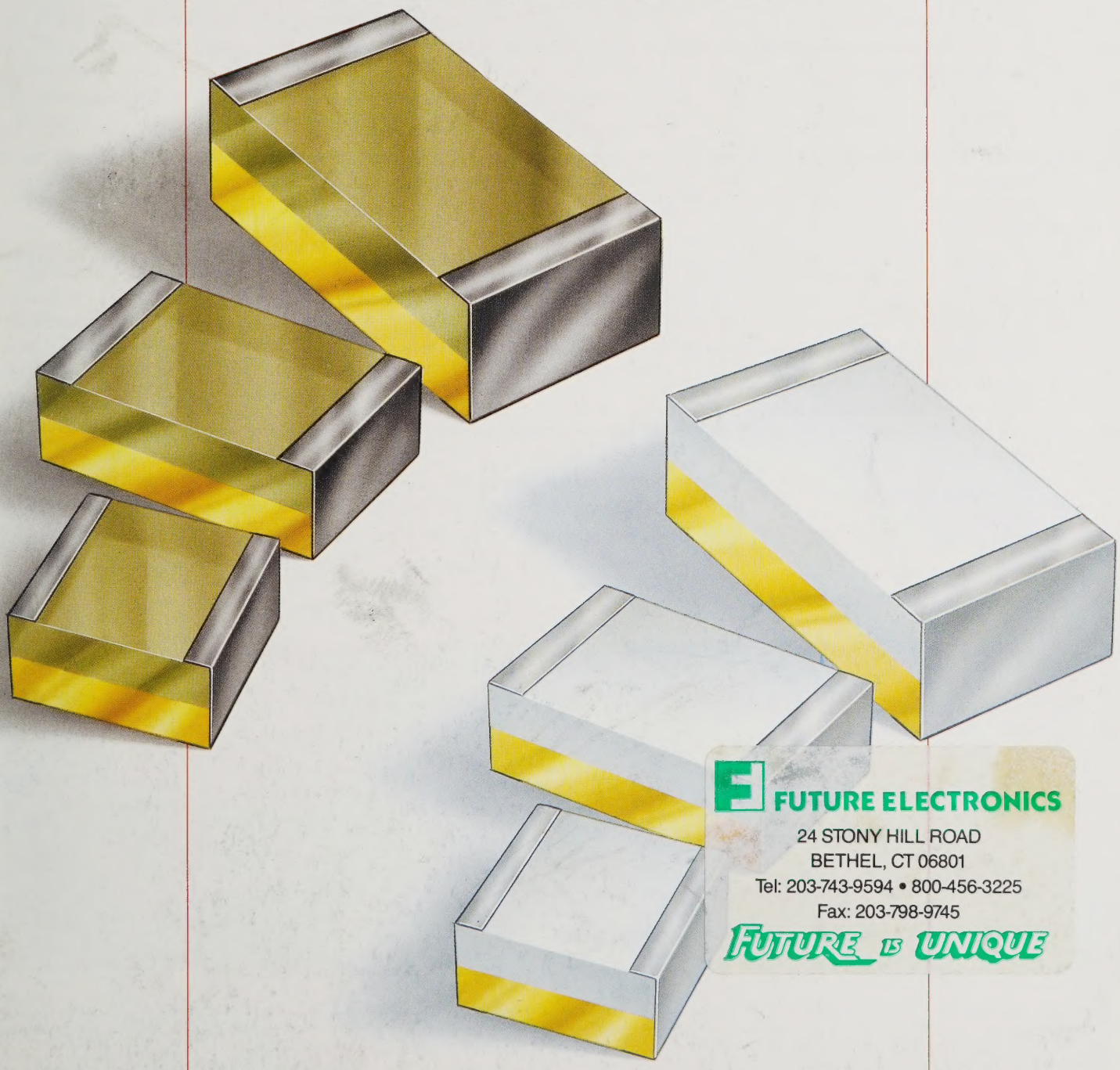
AVX KYOCERA

ACCU-F/ACCU-P THIN-FILM RF/MICROWAVE CAPACITORS



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THE IDEAL CAPACITOR

The non-ideal characteristics of a real capacitor can be ignored at low frequencies. Physical size imparts inductance to the capacitor and dielectric and metal electrodes result in resistive losses, but these often are of negligible effect on the circuit. At the very high frequencies of radiocommunication (>100MHz) and satellite systems (>1GHz), these effects are never negligible. Recognizing that a real capacitor must exhibit inductive and resistive impedances in addition to capacitance, the ideal capacitor for these high frequencies is an ultra low loss component which can be fully characterized in all parameters with total repeatability from unit to unit.

Until recently, most high frequency/microwave capacitors were based on fired-ceramic (porcelain) technology. Layers of ceramic dielectric material and metal alloy electrode paste are interleaved and then sintered in a high temperature oven. This technology exhibits component variability in dielectric quality (losses, dielectric constant and insulation resistance), variability in electrode conductivity and variability in physical size (affecting inductance). An alternate thin film technology has been developed which eliminates these variances. It is this technology which has been fully incorporated into ACCU-F and ACCU-P to provide high frequency capacitors exhibiting truly ideal characteristics.

The main features of ACCU-F and ACCU-P may be summarized as follows:

- ★ High purity of electrodes for very low and repeatable ESR.
- ★ Pure, defect free, low-K dielectric for high breakdown field, high insulation resistance and low losses to frequencies above 40GHz.
- ★ Very tight dimensional control for uniform inductance, unit to unit.
- ★ Very tight capacitance tolerances for high frequency signal applications.

This accuracy so completely sets apart these thin film capacitors from ceramic capacitors that the term ACCU has been employed as the designation for this series of devices, an abbreviation for "accurate".

THIN-FILM TECHNOLOGY

Thin-film technology is commonly used in producing semiconductor devices. In the last two decades, this technology has developed tremendously, both in performance and in process control. Today's techniques enable line definitions of below 1μm, and the controlling of thickness of layers at 100Å ($10^{-2}\mu$m). Applying this technology to the manufacture of capacitors has enabled the development of components where both electrical and physical properties can be tightly controlled.

The thin-film production facilities at AVX consist of:

- Class 1000 clean rooms, with working areas under laminar-flow hoods of class 100, (below 100 particles per cubic foot larger than 0.5μm).
- High vacuum metal deposition systems for high-purity electrode construction.
- Photolithography equipment for line definition down to 2.5μm accuracy.
- Low pressure CVD and plasma-enhanced CVD for various dielectric depositions (CVD = Chemical Vapour Deposition).
- High accuracy, microprocessor-controlled dicing saws for die separation.

ACCU-F TECHNOLOGY

The use of very low-loss dielectric materials, silicon dioxide and silicon nitride in conjunction with highly conductive electrode metals results in low ESR and high Q. These high-frequency characteristics change at a slower rate with increasing frequency than for ceramic microwave capacitors.

Because of the thin-film technology, the above-mentioned frequency characteristics are obtained without any compromise of properties required for surface mounting.

The main **ACCU-F** properties are:

- Internationally agreed sizes and any custom-required sizes (subject to tooling time and charge), all with excellent dimensional control.
- Small size chip capacitors (e.g. 0403, 0504, 0603) are available.
- Tight capacitance tolerances.
- Low ESR at VHF, UHF and microwave frequencies.
- High-stability with respect to time, temperature, frequency and voltage variation.
- Nickel/solder-coated terminations to provide excellent solderability and leach resistance.

ACCU-F FEATURES

ACCU-F meets the fast-growing demand for low-loss (high-Q) capacitors for use in surface mount technology especially for the mobile communications market, such as cellular radio of 450 and 900 MHz, UHF walkie-talkies, UHF cordless telephones to 2.3 GHz, low noise blocks at 11-12.5 GHz and for other VHF, UHF and microwave applications.

ACCU-F is currently unique in its ability to offer very low capacitance values (.1pF) and very tight capacitance tolerances (±.05pF). Typically **ACCU-F** will be used in small signal applications in VCO's, matching networks, filters, etc.

Inspection test and quality control procedures in accordance with CECC, IECQ and USA MIL Standards guarantee product of the highest quality.

APPLICATIONS:

CELLULAR COMMUNICATIONS
CT2/PCN (CORDLESS TELEPHONE/PERSONAL COMM. NETWORKS)
SATELLITE TV
CABLE TV
GPS (GLOBAL POSITIONING SYSTEMS)
VEHICLE LOCATION SYSTEMS
VEHICLE ALARM SYSTEMS
PAGING
MILITARY COMMUNICATIONS
RADAR SYSTEMS
VIDEO SWITCHING
TEST & MEASUREMENTS
FILTERS
VCO's
MATCHING NETWORKS

APPROVALS:

IECQ (complies with USA MIL-I-45208A).

PART NUMBER CODES

	1210	5J	560	GAW	TR

Size: See table for standard sizes

Voltage:
3 = 25V
5 = 50V
1 = 100V
(1) 2 = 200V
(1) 8 = 400V

Temperature Coefficient:
(2) J = 0±30ppm/°C (–55°C to +125°C)
(2) K = 0±60ppm/°C (–55°C to +125°C)

Capacitance:
Capacitance expressed in pF.
2 significant digits + number of zeros.
For values < 10pF, letter R denotes decimal point.
eg. 68pF = 680
8.2pF = 8R2

Tolerance:

for C ≤ 5.6pF
A = ± .05pF
B = ± .1pF
C = ± .25pF

for 5.6pF > C < 10pF
B = ± .1pF
C = ± .25pF
D = ± 0.5pF

for C ≥ 10pF
F = ± 1%
G = ± 2%
J = ± 5%

Specification Code: A = ACCU-F technology

Termination Code: W = Nickel/solder coated (Sn 63, Pb 37)

Packaging Code: TR = Tape and reel (optional)

(1) Please consult factory.

(2) TC's shown are per EIA/IEC Specifications. Actual TC's are as follows:
J = +15 to +29ppm/°C (–55°C to +125°C)
K = +20 to +49ppm/°C (–55°C to +125°C)

TEMP. COEFFICIENT CODE "J" (3) 0±30ppm/°C (–55°C to +125°C)

Size														
Size Code	0403		0504		0505		0603		0805		1206		1210	
(1) Voltage	100	50	100	50	100	50	100	50	100	50	100	50	100	50
(2) Cap in pF — Cap code														
0.1 — 0R1 0.2 — 0R2 0.3 — 0R3 0.4 — 0R4 0.5 — 0R5 0.6 — 0R6 0.7 — 0R7 0.8 — 0R8 0.9 — 0R9	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1.0 — 1R0 1.2 — 1R2 1.5 — 1R5	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1.8 — 1R8 2.2 — 2R2 2.7 — 2R7	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3.3 — 3R3 3.9 — 3R9 4.7 — 4R7		■	■	■	■	■	■	■	■	■	■	■	■	■
5.6 — 5R6 6.8 — 6R8 8.2 — 8R2		■		■		■		■	■	■	■	■	■	■
10 — 100 12 — 120 15 — 150				■		■		■		■	■	■	■	■
18 — 180 22 — 220 27 — 270						■				■		■	■	■
33 — 330 39 — 390 47 — 470										■		■		■
56 — 560 68 — 680 82 — 820												■		■
100 — 101 120 — 121 150 — 151														■

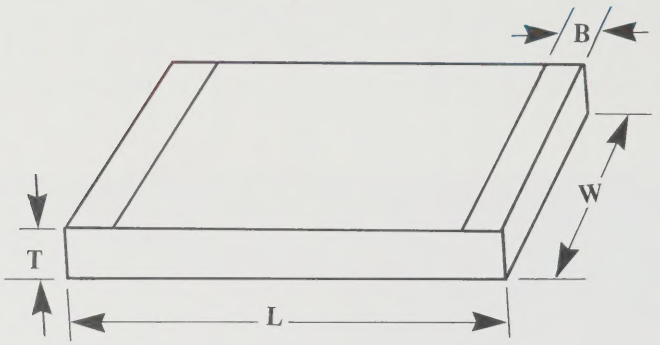
(1) For 200 and 400 volts capacitors please consult factory.
(2) For capacitance values higher than listed in table, please consult factory.
(3) TC shown is per EIA/IEC Specifications.
Actual TC is +15 to +29 ppm/°C (–55°C to +125°C).

TEMP. COEFFICIENT CODE "K"

(3) 0±60ppm/°C (–55C° to +125°C)

Size																	
Size Code	0403		0504		0505			0603			0805			1206		1210	
(1) Voltage	100	50	100	50	100	50	25	100	50	25	100	50	25	100	50	100	50
(2) Cap in pF — Cap code																	
0.1 — 0R1 0.2 — 0R2 0.3 — 0R3 0.4 — 0R4 0.5 — 0R5 0.6 — 0R6 0.7 — 0R7 0.8 — 0R8 0.9 — 0R9	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1.0 — 1R0 1.2 — 1R2 1.5 — 1R5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1.8 — 1R8 2.2 — 2R2 2.7 — 2R7	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3.3 — 3R3 3.9 — 3R9 4.7 — 4R7	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
5.6 — 5R6 6.8 — 6R8 8.2 — 8R2		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
10 — 100 12 — 120 15 — 150		■		■		■	■		■	■	■	■	■	■	■	■	■
18 — 180 22 — 220 27 — 270				■		■	■		■	■		■	■	■	■	■	■
33 — 330 39 — 390 47 — 470							■			■		■	■		■	■	■
56 — 560 68 — 680 82 — 820													■				■
100 — 101 120 — 121 150 — 151													■		■		■
180 — 181 220 — 221 270 — 271																	■

(1) For 200 and 400 volts capacitors please consult factory.
(2) For capacitance values higher than listed in table, please consult factory.
(3) TC shown is per IEC/EIA Specifications.
Actual TC is +20 to +49 ppm/°C (–55°C to +125°C).



Standard sizes – mm (inches) *

	0403	0504	0505	0603	0805	1206	1210
L	1.1±0.1 (0.043±0.004)	1.35±0.1 (0.053±0.004)	1.42±0.1 (0.056±0.004)	1.6±0.1 (0.061±0.004)	2.01±0.1 (0.079±0.004)	3.02±0.1 (0.119±0.004)	3.02±0.1 (0.119±0.004)
W	0.76±0.1 (0.030±0.004)	1.0±0.1 (0.040±0.004)	1.14±0.1 (0.045±0.004)	0.81±0.1 (0.032±0.004)	1.27±0.1 (0.050±0.004)	1.6±0.1 (0.062±0.004)	2.5±0.1 (0.100±0.004)
T	0.63±0.1 (0.025±0.004)	0.63±0.1 (0.025±0.004)	0.63±0.1 (0.025±0.004)	0.63±0.1 (0.025±0.004)	0.63±0.1 (0.025±0.004)	0.84±0.1 (0.033±0.004)	0.84±0.1 (0.033±0.004)
B	0.30±0.1 (0.012±0.004)	0.30±0.1 (0.012±0.004)	0.30±0.1 (0.012±0.004)	0.30±0.1 (0.012±0.004)	0.30±0.1 (0.012±0.004)	0.43±0.1 (0.017±0.004)	0.43±0.1 (0.017±0.004)

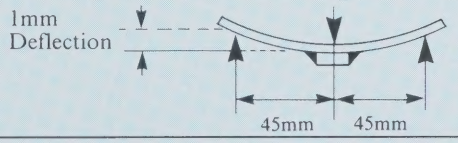
* For other chip sizes please consult factory.

Electrical Specifications

Operating and storage temperature range	–55°C to +125°C	
Temperature coefficients	(1) 0 ± 30ppm/°C(COG or 1B) (1) 0 ± 60ppm/°C(COH or 1F)	
Capacitance measurement	1 MHz, 1 Vrms.	
Rated Voltage/Breakdown Voltage	DC Rated Voltage	Min. Breakdown Voltage
	25 V	300 V
	50 V	500 V
	100 V	800 V
	200 V	1800 V
	400 V	3000 V
Proof voltage	250% U_R for 5 secs.	
Insulation resistance (IR)	$\geq 10^{13}$ ohms	
Ageing characteristic	zero.	
Dielectric absorbtion	0.01%.	

(1) TC's shown are per EIA/IEC Specifications. Actual TC's are as follows:
J = +15 to +29ppm/°C (–55°C to +125°C)
K = +20 to +49ppm/°C (–55°C to +125°C)

Environmental Characteristics

TEST	CONDITIONS	REQUIREMENT
Solderability	Components completely immersed in a solder bath at 260±5°C for 5 secs	Terminations to be well tinned No visible damage
Leach Resistance	Completely immersed in a solder bath at 260±5°C for 60 secs	Dissolution of termination faces ≤15% of area Dissolution of termination edges ≤25% of length
Storage	12 months min with components stored in "as received" packaging	Good solderability
Adhesion	Components mounted to a substrate. A force of 5N applied normal to the line joining the terminations and in a line parallel to the substrate.	No visible damage
Termination Bond Strength	Tested as shown in diagram 	No visible damage Δ C/C ≤±1% or 1pF
Rapid Change of Temperature	Components mounted to a substrate. 5 cycles –55°C to +125°C	No visible damage ΔC/C ≤±1% or 1pF IR ≥0.25 x specified value

ACCU-F is based on well established thin-film technology and materials.

- **Inline Process Control:** This programme forms an integral part of the production cycle and acts as a feedback system to regulate and control production processes. The test procedures, which are integrated into the production process, were especially developed after long research work and are based on the highly developed semiconductor industry test procedures and equipment. These measures help AVX to produce a consistent and high yield line of products.

- **Final Quality Inspection:** Finished parts are tested for standard electrical parameters and visual/mechanical characteristics. Each production lot is 100% evaluated for: capacitance, and proof voltage at 2.5 U_R. In addition, each production lot is evaluated for:

  Average capacitance with histogram printout for capacitance distribution.
  Q at 1MHz with histogram.
  IR and Breakdown Voltage distribution.
  Temperature Coefficient.

- **Quality Assurance:** The reliability of these thin film chip capacitors has been studied intensively for several years. Various measures have been taken to obtain the high reliability required today by the industry. Quality assurance policy is based on well established international industry standards. The reliability of the capacitors is determined by accelerated testing under the following conditions:

Endurance test	125°C, 2 x U_R, 1000 hours
Accelerated Damp Heat Steady State Testing	85°C, 85%RH, U_R, 1000 hours.

ACCU-P TECHNOLOGY

As in the **ACCU-F** series the use of very low-loss dielectric materials (silicon dioxide and silicon nitride) in conjunction with highly conductive electrode metals results in low ESR and high Q. At high-frequency these characteristics change at a slower rate with increasing frequency than conventional ceramic microwave capacitors. Using thin-film technology, the above-mentioned frequency characteristics are obtained without any compromise of properties required for surface mounting. The use of high thermal conductivity materials results in excellent RF power handling capabilities.

The main **ACCU-P** properties are:

- Enhanced RF power handling capability.
- Internationally agreed sizes and any custom-required sizes (subject to tooling time and charge), all with excellent dimensional control.
- Small size chip capacitors are available.
- Tight capacitance tolerances.
- Low ESR at UHF, VHF, Microwave frequencies.
- High-stability with respect to time, temperature, frequency and voltage variation.
- High temperature nickel/solder-coated terminations as standard to provide excellent solderability and leach resistance. Other terminations available on request.

ACCU-P FEATURES

★ The **ACCU-P** has the same unique features as the **ACCU-F** capacitor such as low ESR, high Q, availability of very low capacitance values and very tight capacitance tolerances.

★ The RF power handling capability of the **ACCU-P** allows for its usage in both small signal as well as in RF power applications.

★ Inspection, test and quality control procedures in accordance with CECC, IECQ and USA MIL Standards guarantee product of the highest quality.

APPLICATIONS:

Cellular-Radio base stations
Military and commercial transceivers
Filters
Test and Measurements
Satellite TV and Data Transmission
RF Amplifiers

APPROVALS:

IECQ (complies with USA MIL-I-45208A).

QUALITY ASSURANCE

Recognising the requirement of the Military/Aerospace/High Rel industry for components of the very highest quality, AVX has devised a specially rigorous Quality Assurance programme for **ACCU-P** capacitors, based on MIL-STD-202, MIL-C-55681 and their equivalent European standards.

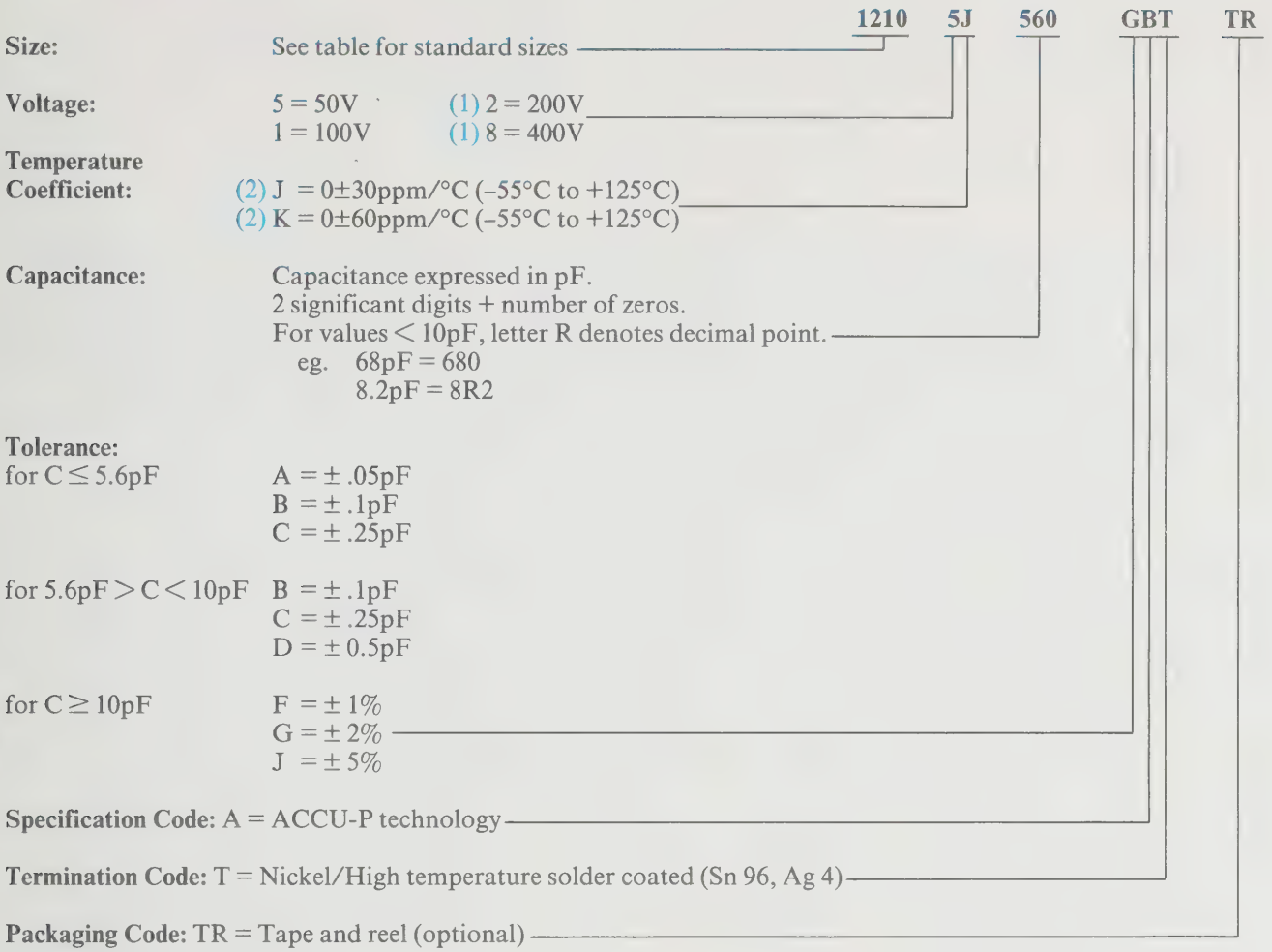
Before release, every production batch is tested to the following programme:

100% Test	Conditions	Reference
Capacitance	1MHz	MIL-STD-202F Method 305
Proof Voltage	$2.5U_R$	MIL-STD-202F Method 301

Sample Test	Conditions	Reference
Cap, Q and ESR High Frequency	Boonton 34A	ASTM Method F752-82
Insulation Resistance	U_R, $\geqslant 10^{13}\ \Omega$	MIL-STD-202F Method 302
Dielectric Withstanding Voltage	2.5 x U_R, 1 sec	MIL-STD-202F Method 301
Temperature Coefficient (TCC)	–55°C, +25°C, +125°C	MIL-STD-202F Method 304
Endurance	125°C, 2 x U_R, 1000 Hours	MIL-STD-202F Method 108A
Accelerated Damp Heat Steady State	85°C, 85% RH, U_R, 1000 Hours	MIL-STD-202F Method 103B
Solderability	235°C, 5 secs.	MIL-STD-202F Method 208
Leach Resistance	260°C, 60 secs	MIL-STD-202F Method 210A
Immersion	260°C, 10 cycles	MIL-STD-202F Method 104A

- Samples and test data for each production batch are retained at the factory.
- Special quality assurance programmes can be tailored to meet specific customer requirements.

PART NUMBER CODES



Size: See table for standard sizes

Voltage: 5 = 50V (1) 2 = 200V
1 = 100V (1) 8 = 400V

Temperature Coefficient:
(2) J = 0±30ppm/°C (–55°C to +125°C)
(2) K = 0±60ppm/°C (–55°C to +125°C)

Capacitance: Capacitance expressed in pF.
2 significant digits + number of zeros.
For values < 10pF, letter R denotes decimal point.
eg. 68pF = 680
8.2pF = 8R2

Tolerance:
for C ≤ 5.6pF
A = ± .05pF
B = ± .1pF
C = ± .25pF

for 5.6pF > C < 10pF
B = ± .1pF
C = ± .25pF
D = ± 0.5pF

for C ≥ 10pF
F = ± 1%
G = ± 2%
J = ± 5%

Specification Code: A = ACCU-P technology

Termination Code: T = Nickel/High temperature solder coated (Sn 96, Ag 4)

Packaging Code: TR = Tape and reel (optional)

(1) Please consult factory.

(2) TC's shown are per EIA/IEC Specifications. Actual TC's are as follows:
J = +15 to +29ppm/°C (–55°C to +125°C)
K = +20 to +49ppm/°C (–55°C to +125°C)

TEMP. COEFFICIENT CODE "J" (5) 0±30ppm/°C (–55°C to +125°C)

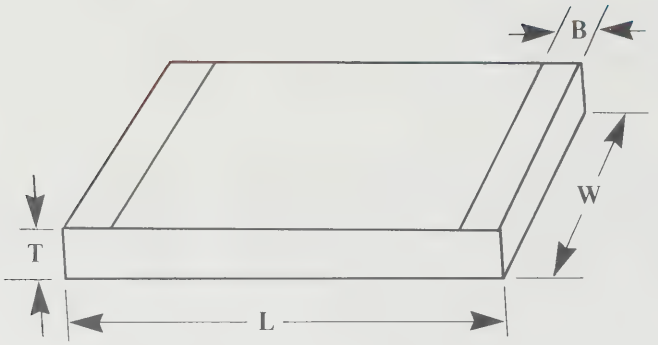
Size												
Size Code	(3) 0504		0505		(3) 0603		0805		(3) 1206		1210	
(1) Voltage	100	50	100	50	100	50	100	50	100	(4) 50	100	(4) 50
Cap in pF — Cap code												
0.1 — 0R1 0.2 — 0R2 0.3 — 0R3 0.4 — 0R4 0.5 — 0R5 0.6 — 0R6 0.7 — 0R7 0.8 — 0R8 0.9 — 0R9												
1.0 — 1R0 1.2 — 1R2 1.5 — 1R5												
1.8 — 1R8 2.2 — 2R2 2.7 — 2R7												
3.3 — 3R3 3.9 — 3R9 4.7 — 4R7												
5.6 — 5R6 6.8 — 6R8 8.2 — 8R2												
10 — 100 12 — 120 15 — 150												
18 — 180 22 — 220 27 — 270												
33 — 330 39 — 390 47 — 470												
56 — 560 68 — 680 82 — 820												
100 — 101 120 — 121 150 — 151												

(1) For 200 and 400 volts capacitors please consult factory.
(2) For capacitance values higher than listed in table, please consult factory.
(3) For these sizes please consult factory.
(4) For 50 volt ranges in sizes 1206 and 1210, please consult factory.
(5) TC shown is per EIA/IEC Specifications.
Actual TC is +15 to +29ppm/°C (–55°C to +125°C)

TEMP. COEFFICIENT CODE "K" 0±60ppm/°C (–55°C to +125°C)

Size												
Size Code	(3) 0504		0505		(3) 0603		0805		1206		1210	
(1) Voltage	100	50	100	50	100	50	100	50	100	(4) 50	100	(4) 50
(2) Cap in pF — Cap code												
0.1 — 0R1 0.2 — 0R2 0.3 — 0R3 0.4 — 0R4 0.5 — 0R5 0.6 — 0R6 0.7 — 0R7 0.8 — 0R8 0.9 — 0R9												
1.0 — 1R0 1.2 — 1R2 1.5 — 1R5												
1.8 — 1R8 2.2 — 2R2 2.7 — 2R7												
3.3 — 3R3 3.9 — 3R9 4.7 — 4R7												
5.6 — 5R6 6.8 — 6R8 8.2 — 8R2												
10 — 100 12 — 120 15 — 150												
18 — 180 22 — 220 27 — 270												
33 — 330 39 — 390 47 — 470												
56 — 560 68 — 680 82 — 820												
100 — 101 120 — 121 150 — 151												
180 — 181 220 — 221 270 — 271												

(1) For 200 and 400 volts capacitors please consult factory.
(2) For capacitance values higher than listed in table, please consult factory.
(3) For these sizes please consult factory.
(4) For 50 volt ranges in sizes 1206 and 1210, please consult factory.
(5) TC shown is per IEC/EIA Specifications.
Actual TC is +20 to +49ppm/°C (–55°C to +125°C)



(1) Standard sizes – mm (inches)

	(2) 0504	0505	(1) 0603	0805	(2) 1206	1210
L	1.35±0.1 (0.053±0.004)	1.42±0.1 (0.056±0.004)	1.6±0.1 (0.061±0.004)	2.01±0.1 (0.079±0.004)	3.02±0.1 (0.119±0.004)	3.02±0.1 (0.119±0.004)
W	1.0±0.1 (0.040±0.004)	1.14±0.1 (0.045±0.004)	0.81±0.1 (0.032±0.004)	1.27±0.1 (0.050±0.004)	1.6±0.1 (0.062±0.004)	2.5±0.1 (0.100±0.004)
T	0.84±0.1 (0.033±0.004)	0.84±0.1 (0.033±0.004)	0.63±0.1 (0.025±0.004)	1.07±0.1 (0.042±0.004)	1.07±0.1 (0.042±0.004)	1.07±0.1 (0.042±0.004)
B	0.30±0.1 (0.012±0.004)	0.30±0.1 (0.012±0.004)	0.30±0.1 (0.012±0.004)	0.30±0.1 (0.012±0.004)	0.43±0.1 (0.017±0.004)	0.43±0.1 (0.017±0.004)

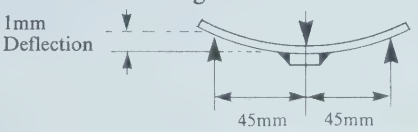
(1) For other chip sizes please consult factory.
(2) For these sizes please consult factory.

Electrical Specifications

Operating and storage temperature	–55°C to +125°C	
(1) Temperature coefficients	0 ± 30ppm/°C(COG or 1B) – dielectric code "J" 0 ± 60ppm/°C – dielectric code "K"	
Capacitance measurement	1 MHz, 1 Vrms.	
Rated Voltage/Breakdown Voltage	DC Rated Voltage	Min. Breakdown Voltage
	50 V	500 V
	100 V	800 V
	200 V	1800 V
	400 V	3000 V
Proof voltage	250% U_R for 5 secs.	
Insulation resistance (IR)	$\geq 10^{13}$ ohms	
Ageing characteristic	Zero.	
Dielectric absorbtion	0.01%.	

(1) TC's shown are per EIA/IEC Specifications. Actual TC's are as follows: J = +15 to +29ppm/°C (–55°C to +125°C)
K = +20 to +49ppm/°C (–55°C to +125°C)

Mechanical Characteristics

TEST	CONDITIONS	REQUIREMENT
Solderability **MIL-STD-202F Method 208**	Components completely immersed in a solder bath at 260±5°C for 5 secs	Terminations to be well tinned, minimum 95% coverage
Leach Resistance **MIL-STD-202F Method 210A**	Completely immersed in a solder bath at 260±5°C for 60 secs	Dissolution of termination faces ≤ 15% of area Dissolution of termination edges ≤25% of length
Adhesion **MIL-STD-202F Method 211A**	Components mounted to a substrate. A force of 5N applied normal to the line joining the terminations and in a line parallel to the substrate.	No visible damage
Termination Bond Strength	Tested as shown in diagram 	No visible damage Δ C/C ≤±1% or 1pF
Pull Test **MIL-STD-202F Method 211A**	500g for 10 secs	No visible damage ΔC/C ≤±1% or 1pF IR ≥0.25 x specified value
High Frequency Vibration **MIL-STD-202F Method 204D**	55Hz to 2000Hz, 20G	IR $\geq 10^{11}\Omega$
Storage	12 months minimum with components stored in "as received" packaging	Good solderability

Environmental Characteristics

TEST	CONDITIONS	REQUIREMENT
Immersion **MIL-STD-202F Method 104B**	2 cycles, 15 mins, 65°C	C and Q remain within initial limits
Life **MIL-STD-202F Method 108A**	125°C, 2 x U_R, 1000 hours	Δ C/C ≤ 2% IR ≥ $10^{13}\ \Omega$
Accelerated Damp Heat Steady State **MIL-STD-202F Method 103B**	85°C, 85% RH, U_R, 1000 hours	IR < 10% change
Moisture Resistance **MIL-STD-202F Method 106E**	20 cycles (without 7A and 7B)	C and IR remain within initial limits
Thermal Shock **MIL-STD-202F Method 107E**	–55°C to +125°C, 150 cycles	IR $\geq 10^{11}\Omega$
Resistance to Solder Heat **MIL-STD-202F Method 210A**	260°C ± 5°C for 60 secs	C and Q remain within initial limits

RF POWER APPLICATIONS

In RF power applications, capacitor losses generate heat. Two factors of particular importance to designers are:

- Minimising the generation of heat
- Dissipating heat as efficiently as possible.

CAPACITOR HEATING

- The major source of heat generation in a capacitor in RF power applications is a function of RF current (I) and ESR, from the relationship:

$$\text{Power dissipation} = I^2_{RMS} \times ESR$$

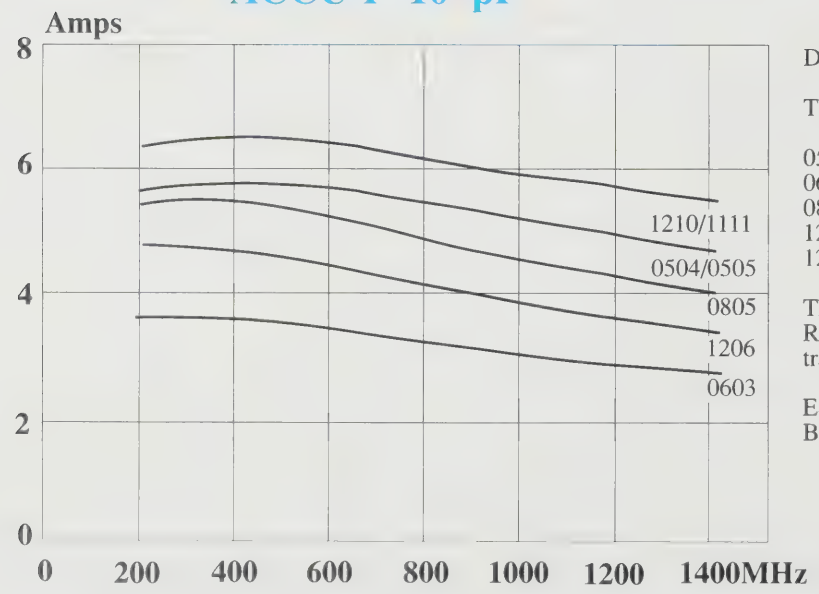
- **ACCU-P** capacitors are specially designed to minimise ESR and therefore RF heating. Values of ESR for **ACCU-P** capacitors are significantly less than those of ceramic MLC components currently available.

HEAT DISSIPATION

- Heat is dissipated from a capacitor through a variety of paths, but the key factor in the removal of heat is the thermal conductivity of the capacitor material.
- The higher the thermal conductivity of the capacitor, the more rapidly heat will be dissipated.
- The table below illustrates the importance of thermal conductivity to the performance of **ACCU-P** in power applications.

Product	Material	Thermal Conductivity W/mK
ACCU-P	Alumina	18.9
Microwave MLC	Magnesium Titanate	6.0

Power Handling
ACCU-P 10 pF



Data used in calculating the graph:

Thermal impedence of capacitors:

0504/0505	5°C/W
0603	11°C/W
0805	8.5°C/W
1206	8°C/W
1210/111	5°C/W

Thermal impedence measured using RF generator, amplifier and strip-line transformer.

ESR pf capacitors measured on Boonton 34A

THERMAL IMPEDANCE

Thermal impedance of **ACCU-P** chips is shown below compared with the thermal impedance of Microwave MLC's.

The thermal impedance expresses the temperature difference in °C between chip centre and termination caused by a power dissipation of 1 watt in the chip. It is expressed in °C/W.

Capacitor Type	Chip size	Thermal Impedance °C/W
ACCU-P	0504/0505	5
	0603	11
	0805	6.5
	1206	8
	1210/1111	5
Microwave MLC	0505	12
	1111	7.5

ADVANTAGES OF ACCU-P IN RF POWER CIRCUITS

The specially optimised design of **ACCU-P** offers the designer of RF power circuits the following advantages:

★ Reduced power losses due to the inherently low ESR of **ACCU-P.**

★ Increased power dissipation due to the high thermal conductivity of **ACCU-P.**

PRACTICAL APPLICATION IN RF POWER CIRCUITS

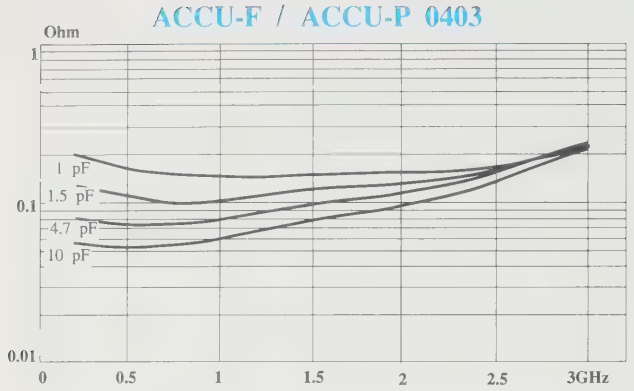
★ There is a wide variety of different experimental methods for measuring the power handling performance of a capacitor in RF power circuits. Each method has its own problems and few of them exactly reproduce the conditions present in "real" circuit applications.

★ Similarly, there is a very wide range of possible different circuit applications, all with their unique characteristics and operating conditions which cannot possibly be covered by such "theoretical" testing.

★ THE ONLY TRUE TEST OF A CAPACITOR IN ANY PARTICULAR APPLICATION IS ITS PERFORMANCE UNDER OPERATING CONDITIONS IN THE ACTUAL CIRCUIT.

ESR

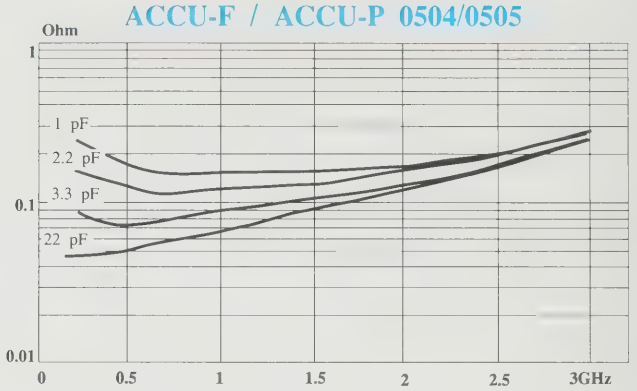
ACCU-F / ACCU-P 0403



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

ESR

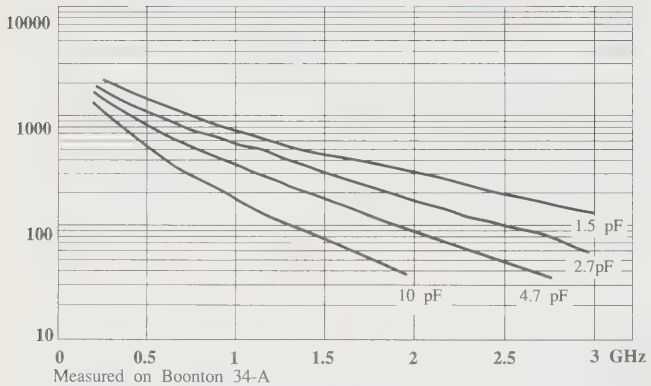
ACCU-F / ACCU-P 0504/0505



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Q

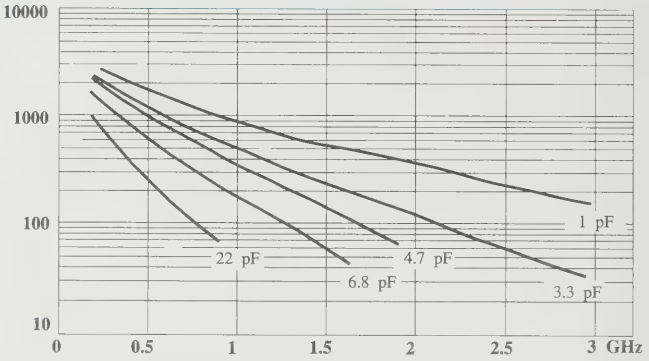
ACCU-F / ACCU-P 0403



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Q

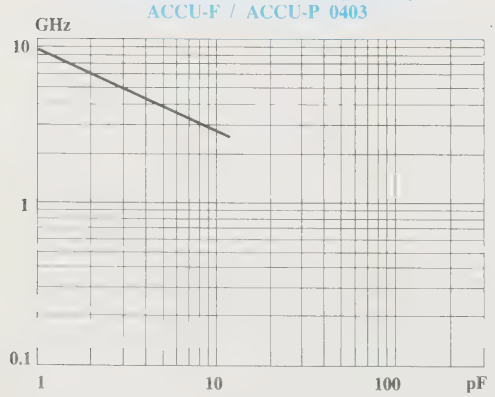
ACCU-F / ACCU-P 0504/0505



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Self Resonant Frequency

ACCU-F / ACCU-P 0403



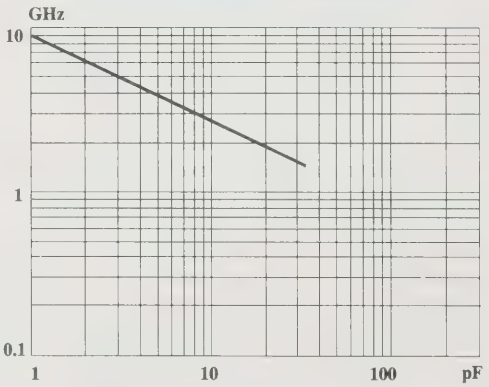
L (self inductance) ~ 0.35 nH

NOTE
L and SRF are obtained from the measured increase in effective capacitance as the frequency is increased

Measured on the Boonton 34A

Self Resonant Frequency

ACCU-F / ACCU-P 0504/0505

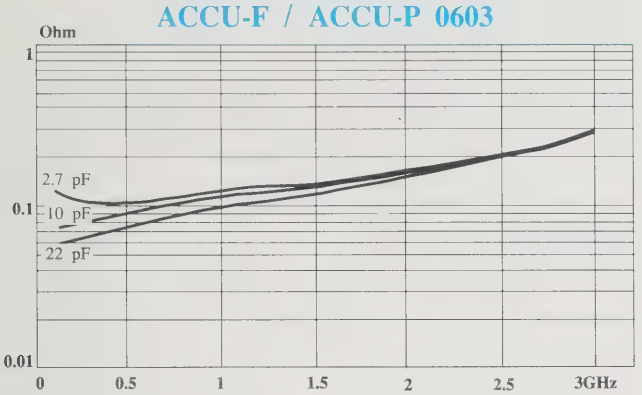


L (self inductance) ~ 0.54 nH

NOTE
L and SRF are obtained from the measured increase in effective capacitance as the frequency is increased

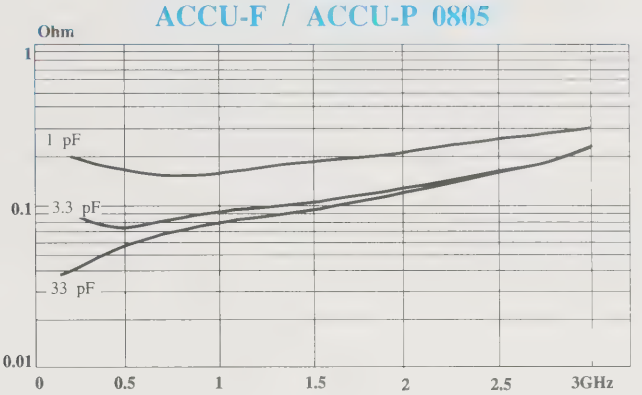
Measured on the Boonton 34A

ESR
ACCU-F / ACCU-P 0603



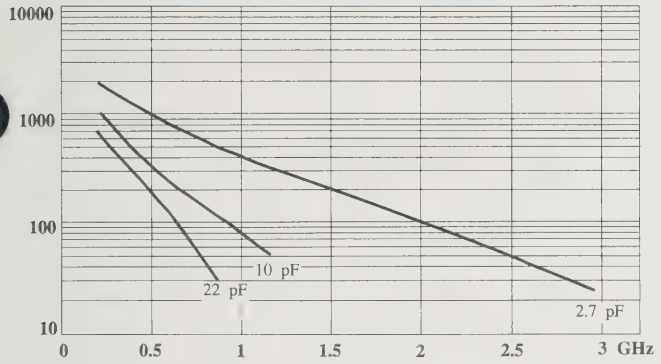
Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

ESR
ACCU-F / ACCU-P 0805



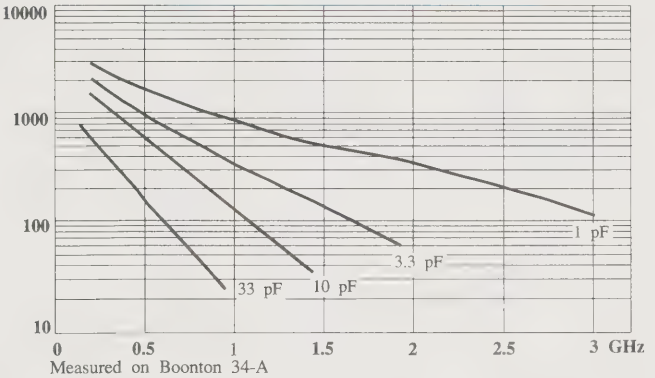
Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Q
ACCU-F / ACCU-P 0603



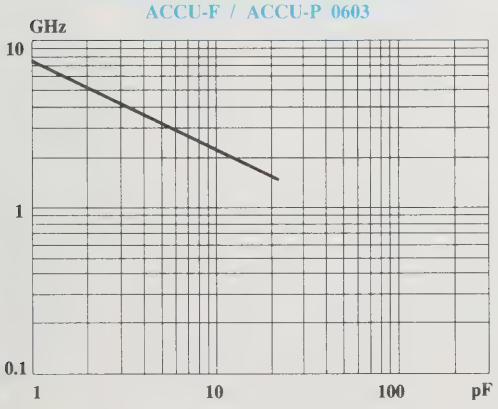
Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Q
ACCU-F / ACCU-P 0805



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Self Resonant Frequency
ACCU-F / ACCU-P 0603

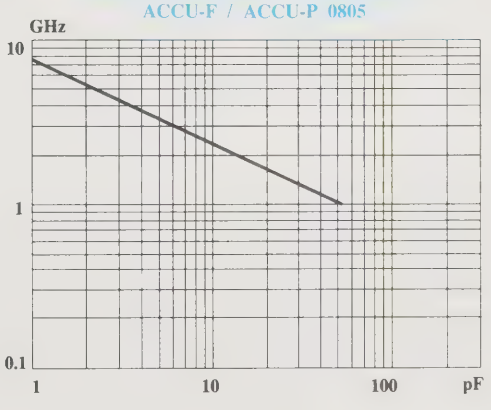


L (self inductance)~0.78 nH

NOTE
L and SRF are obtained from the measured increase in effective capacitance as the frequency is increased

Measured on the Boonton 34A

Self Resonant Frequency
ACCU-F / ACCU-P 0805



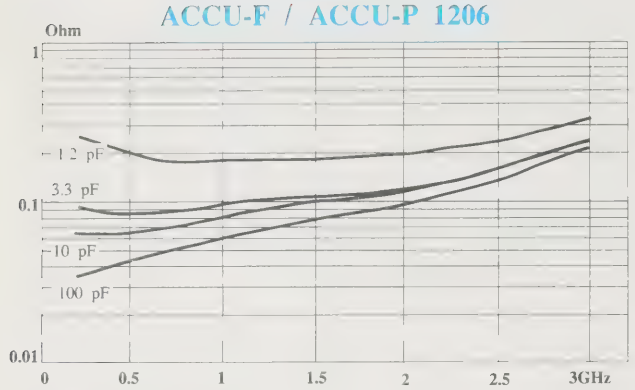
L (self inductance)~0.82 nH

NOTE
L and SRF are obtained from the measured increase in effective capacitance as the frequency is increased

Measured on the Boonton 34A

ESR

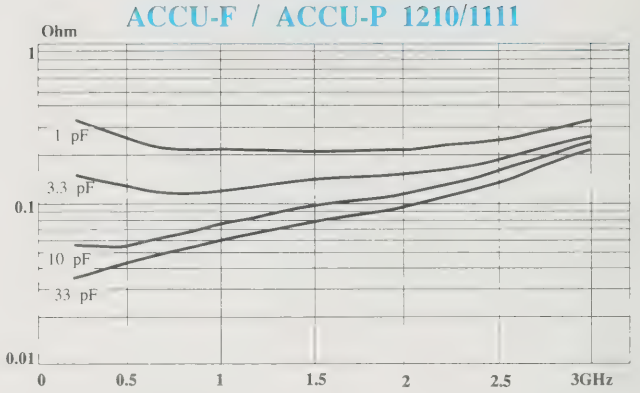
ACCU-F / ACCU-P 1206



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

ESR

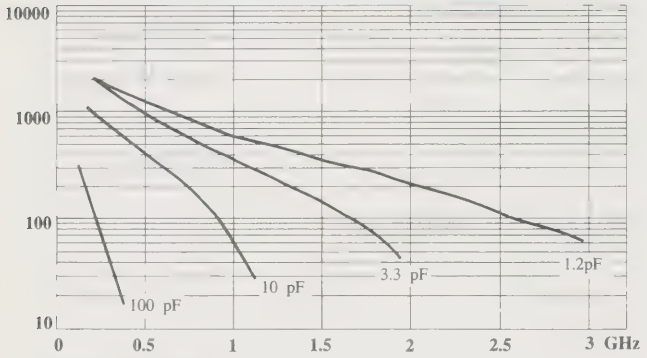
ACCU-F / ACCU-P 1210/1111



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Q

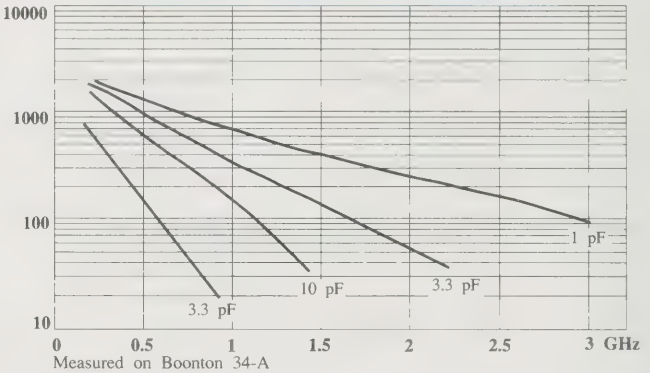
ACCU-F / ACCU-P 1206



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Q

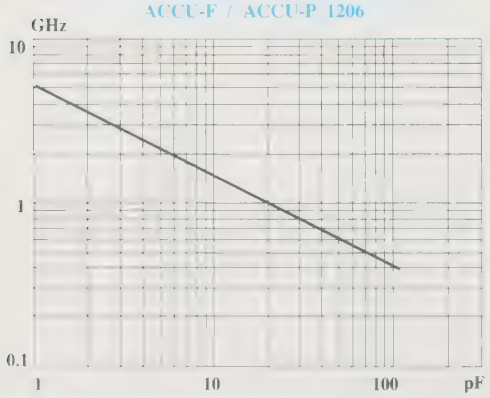
ACCU-F / ACCU-P 1210/1111



Measured on Boonton 34-A
(34-A limits measurements to 3 GHz)

Self Resonant Frequency

ACCU-F / ACCU-P 1206



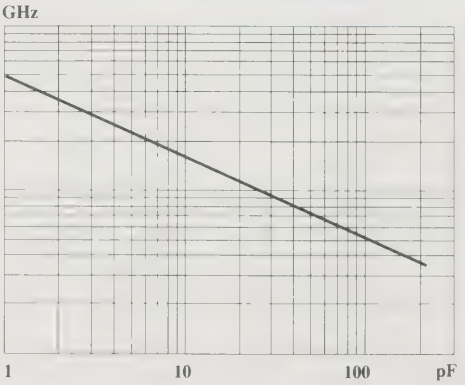
L (self inductance)~1.35 nH

NOTE
L and SRF are obtained from the measured increase in effective capacitance as the frequency is increased

Measured on the Boonton 34A

Self Resonant Frequency

ACCU-F / ACCU-P 1210/1111

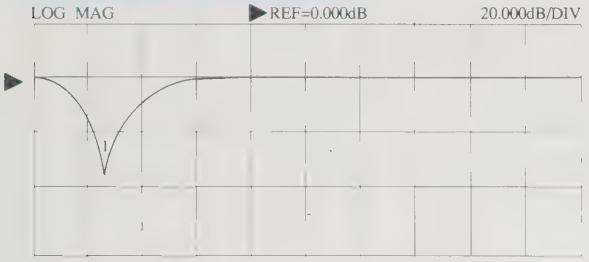


L (self inductance)~1.02 nH

NOTE
L and SRF are obtained from the measured increase in effective capacitance as the frequency is increased

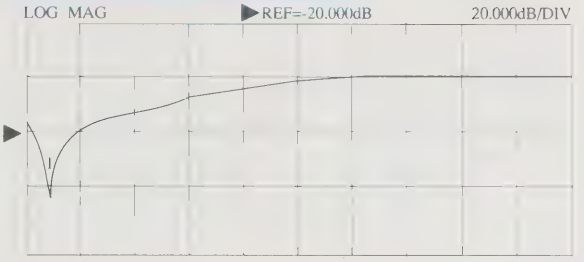
Measured on the Boonton 34A

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=0.000dB 20.000dB/DIV



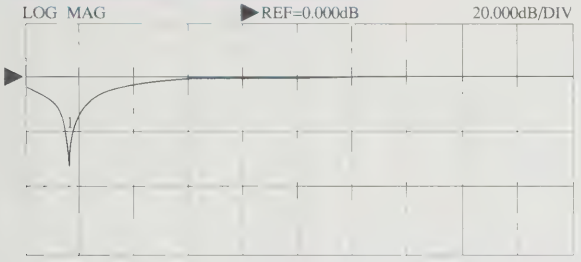
4.0000 GHz 40.0000
0505 1pF MARKER 1: SRF =8.752 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=-20.000dB 20.000dB/DIV



2.0000 GHz 20.0000
0505 10pF MARKER 1: SRF =2.864 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=0.000dB 20.000dB/DIV

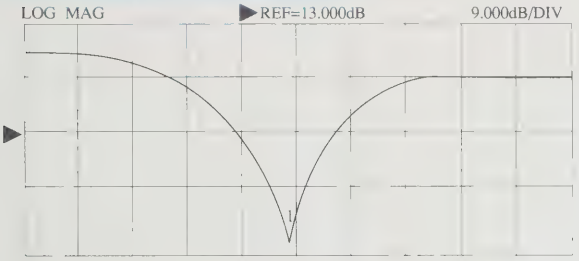


4.0000 GHz 40.0000
0603 1pF MARKER 1: SRF =6.88 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=20.000dB 20.000dB/DIV

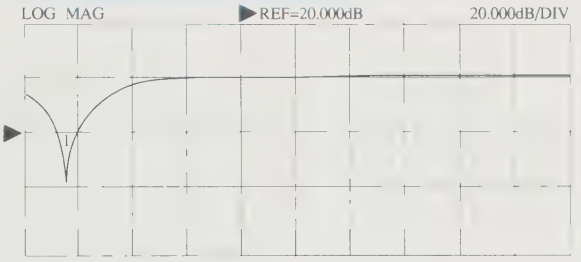
2.0000 GHz 20.0000
0603 2.7pF MARKER 1: SRF =3.764 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=13.000dB 9.000dB/DIV



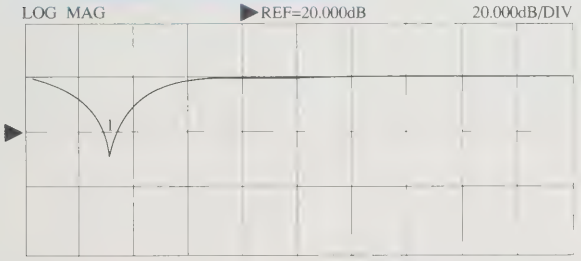
2.0000 GHz 20.0000
0805 0.6pF MARKER 1: SRF =10.748 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=20.000dB 20.000dB/DIV



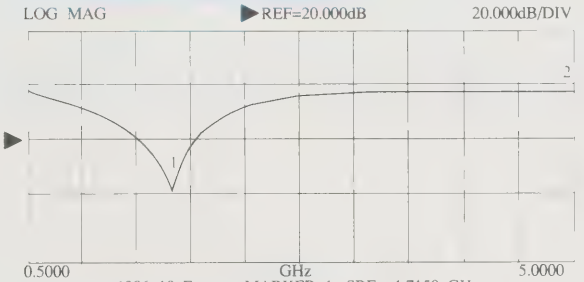
2.0000 GHz 20.0000
0805 3.3pF MARKER 1: SRF =3.548 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=20.000dB 20.000dB/DIV



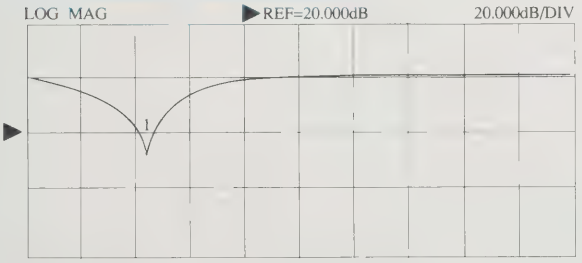
2.0000 GHz 20.0000
1206 1pF MARKER 1: SRF =4.88 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=20.000dB 20.000dB/DIV



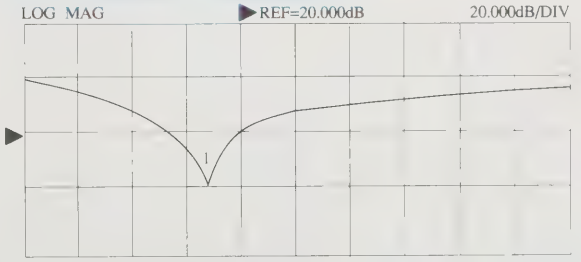
0.5000 GHz 5.0000
1206 10pF MARKER 1: SRF =1.7150 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=20.000dB 20.000dB/DIV



2.0000 GHz 20.0000
1210 1.2pF MARKER 1: SRF =5.888 GHz

S21 FORWARD TRANSMISSION
LOG MAG ▶REF=20.000dB 20.000dB/DIV



0.5000 GHz 5.0000
1210 10pF MARKER 1: SRF =2.0390 GHz

Measured using WILTRON 360 VECTOR ANALYZER with WILTRON 3680K UNIVERSAL TEST FIXTURE

Automatic Insertion Packaging

TAPE & REEL All tape and reel specifications are in compliance with EIA RS481 (equivalent to IEC 286 part 3).

Sizes 0504, 0603, 0805, 0806, 1206, 1210
–8mm carrier
–Reeled quantities: Reels of min. 3,000 pieces

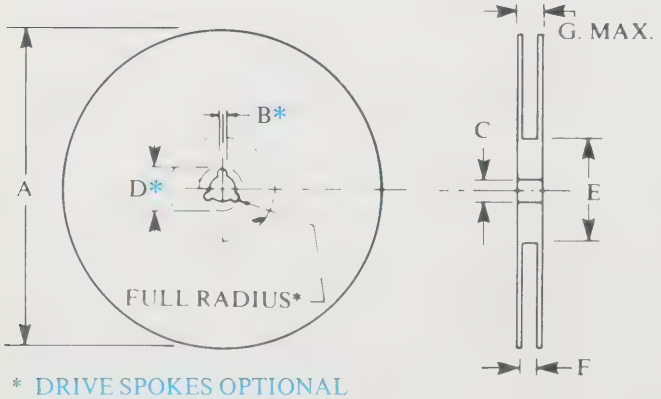
Reel Dimensions mm (inches)

(1) A	* B	C	* D	E	F	G
178 ± 2.0 (7.0 ± 0.079)	2.0 (0.079)	13 ± 0.5 (0.512 ± 0.020)	20.2 MIN (0.795 MIN)	50 MIN (1.969 MIN)	10.0 ± 1.5 0.394 ± 0.050	14.9 (0.587)
Metric dimensions will govern. Inch measurements rounded and for reference only.						

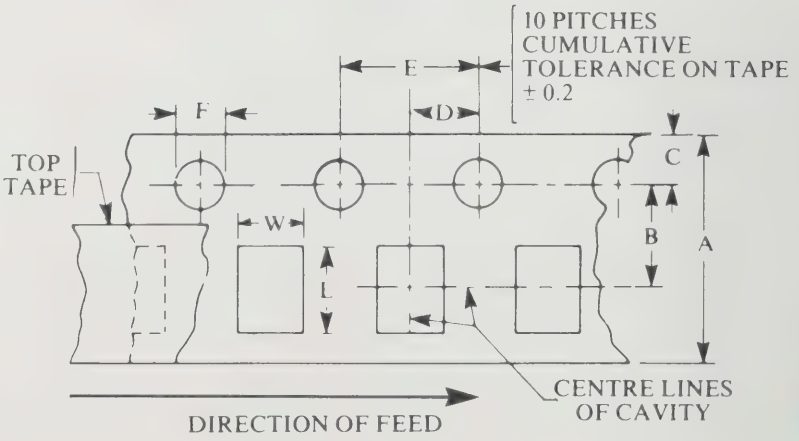
(1) For availability of 330mm (13 inch) reels, please consult factory.

Carrier Dimensions mm (inches)

A	B	C	D	E	F
8.0 ± 0.3 (0.315 ± 0.012)	3.5 ± 0.05 (0.138 ± 0.002)	1.75 ± 0.1 (0.069 ± 0.004)	2.0 ± 0.05 (0.079 ± 0.002)	4.0 ± 0.1 (0.157 ± 0.004)	$1.5\ ^{+0.1}_{-0.0}$ $0.059\ ^{+0.004}_{-0.000}$
Note: The nominal dimensions of the component compartment are derived from the component size.					



* DRIVE SPOKES OPTIONAL
IF USED ASTERISKED
DIMENSIONS APPLY.



NOTE: AVX reserves the right to change the information published herein without notice.

Design Kit Type 100

Order Number: ACCU-F0805KIT01

Volts	Capacitors Value pF	Tolerance
100	0.5	B
	0.6	B
	0.7	B
	0.8	B
	0.9	B
	1.0	B
	1.2	B
	1.5	B
	1.8	B
	2.0	B
	2.2	B
	2.4	B
	2.7	B
	3.0	B
	3.3	B
	3.9	B
	4.7	B
	5.6	B
	6.8	B
	8.5	B
	10	G
	12	G
	15	G
50	18	G
	22	G
	27	G
	33	G
	39	G
	47	G
	56	G

300 CAPACITORS, 10 EACH OF 30 VALUES

TOLERANCE B = ± 0.1pF
G = ± 2%

Design Kit Type 200

Order Number: ACCU-F0505KIT01

Volts	Capacitors Value pF	Tolerance
100	0.3	B
	0.4	B
	0.5	B
	0.6	B
	0.7	B
	0.8	B
	0.9	B
	1.0	B
	1.2	B
	1.5	B
	1.8	B
	2.0	B
	2.2	B
	2.4	B
	2.7	B
	3.0	B
	3.3	B
	4.7	B
	5.6	B
	6.8	B
	8.2	B
50	10	G
	12	G
	15	G
	18	G
	22	G
	27	G
	33	G

300 CAPACITORS, 10 EACH OF 30 VALUES

TOLERANCE B = ± 0.1pF
G = ± 2%

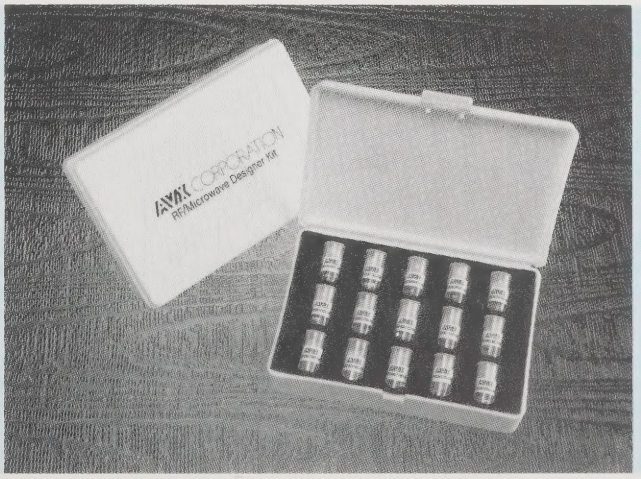
Design Kit Type 400

Order Number: ACCU-F0603KIT01

Volts	Capacitors Value pF	Tolerance
100	0.1	B
	0.2	B
	0.3	B
	0.4	B
	0.5	B
	0.6	B
	0.7	B
	0.8	B
	0.9	B
	1.0	B
	1.1	B
	1.2	B
	1.5	B
	1.8	B
	2.0	B
	2.2	B
	2.4	B
	2.7	B
	3.0	B
	3.3	B
50	4.7	B
	5.6	C
	6.8	C
	8.2	C
	9.1	C
	10	G
	12	G
	15	G
	18	G
	22	G

300 CAPACITORS, 10 EACH OF 30 VALUES

TOLERANCE B = ± 0.1pF
C = ± 0.25pF
G = ± 2%



Tuning Kit Type 500

Order Number: ACCU-F0505KIT02

Volts	Capacitors Value pF	Tolerance
100	0.1	B
	0.2	B
	0.3	B
	0.4	B
	0.5	B
	0.6	B
	0.7	B
	0.8	B
	0.9	B
	1.0	B
	1.1	B
	1.2	B
	1.3	B
	1.4	B
	1.5	B
	1.6	B
	1.7	B
	1.8	B
	1.9	B
	2.0	B
	2.2	B
	2.7	B
	3.3	B
	3.9	B
	4.7	B
50	5.6	B
	6.8	B
	8.2	B
	9.1	B
	10.0	F

300 CAPACITORS, 10 EACH OF 30 VALUES

TOLERANCE B = ± 0.1pF
F = ± 1%

Designer Kit Type 600

Order Number: ACCU-P0805KIT01

Volts	Capacitors Value pF	Tolerance
100	0.5	B
	0.7	B
	1.0	B
	1.2	B
	1.5	B
	1.8	B
	2.2	B
	2.7	B
	3.3	B
	3.9	B
	4.7	B
	5.6	B
	6.8	B
	10	G
50	18	G

150 CAPACITORS, 10 EACH OF 15 VALUES

TOLERANCE B = ± 0.1pF
G = ± 2%

Designer Kit Type 700

Order Number: ACCU-P1210KIT02

Volts	Capacitors Value pF	Tolerance
100	1.0	B
	1.5	B
	1.8	B
	2.2	B
	2.7	B
	3.3	B
	4.7	B
	5.6	B
	6.8	B
	10	G
	12	G
	18	G
	22	G
	27	G
	33	G

150 CAPACITORS, 10 EACH OF 15 VALUES

TOLERANCE B = ± 0.1pF
G = ± 2%

International Sales Offices

AVX Limited,
Stafford House,
Station Road,
Aldershot, Hants GU11 1BA
Tel: (0252) 336868
Telex: 858473
Fax: (0252) 346643

AVX S.A.,
Zone d'Activites de Courtaboeuf,
Boite Postale 213
91941 Les Ulis Cedex, France
Tel: (1) 69286566. Telex: 600784
Fax: (1) 69287387

AVX GmbH,
Postfach 1110,
Liebigstr. 1A,
D-8047 Karlsfeld, W. Germany
Tel: 08131 9004-0. Telex: 527577
Fax: 08131 9004-44

AVX s.r.l.
20091 Bresso
Via Manzoni 14/16
Italy
Tel: (2) 6142574/3479
Fax: (2) 6142576

AVX Corporation,
P.O. Box 867,
Myrtle Beach,
SC 29577,
U.S.A.
Tel: 8034489411
Fax: 8034487537

AVX Asia Ltd.,
3rd Flr., Hilder Centre,
2 Sung Ping St.,
Hunghom, Kowloon,
Hong Kong
Tel: 3633303
Telex: 49576
Fax: 37658185

AVX Israel Ltd. (Sales),
P.O. Box 12319,
Industrial Area,
46733 Herzlia,
Israel
Tel: (52) 573873
Fax: (52) 573853

List of Representatives

Eastern Area Manager
Ray Kelly
AVX Corporation
A Kyocera Group Company
313 Boston Post Road West, Ste. 280
Marlborough, MA 01752
Telephone: (508) 485-8114
FAX: 508-485-8471

Northeast Region
Al Gray
AVX Corporation
A Kyocera Group Company
313 Boston Post Road West, Ste. 280
Marlborough, MA 01752
Telephone: (508) 485-8114
FAX: 508-485-8471

John E. Boeing Co., Inc.
10 North Road
Chelmsford, MA 01824-2711
Telephone: (508) 256-5800

John E. Boeing Co., Inc.
101A Harvard Park
North Plains Industrial Ave.
Wallingford, CT 06492
Telephone: (203) 265-1318

PC Electronics, Inc.
G.P. Box 4543
San Juan, Puerto Rico 00936
Telephone: (809) 758-9805

Burgin-Kreh Assoc., Inc.
7000 Security Blvd., Suite 330
Baltimore, MD 21207
Telephone: (301) 265-8500

Burgin-Kreh Assoc., Inc.
P.O. Box 4455
8314 Timberlake Road
Lynchburg, VA 24502
Telephone: (804) 239-2626

Comtronic Assoc., Inc.
555 Broad Hollow Road
Melville, NY 11747
Telephone: (516) 249-0505

Omni Sales, Inc.
1016 Bethlehem Pike
Erdenheim, PA 19118
Telephone: (215) 233-4600

Professional Marketing Associates
319 Littleton Rd.
Suite 301
Westford, MA 01886
Telephone: (508) 392-0762

Northern Region
Steve Wong
AVX Corporation
A Kyocera Group Company
7470 Bath Road
Mississauga, Ontario
Canada L4T 1L2
Telephone: (416) 671-8942
FAX: 416-671-3746

Comstrand, Inc.
2852 Anthony Lane South
Minneapolis, MN 55418
Telephone: (612) 788-9234

Bob Dean, Inc.
2415 Triphammer Road
P.O. Box E
Ithaca, NY 14851
Telephone: (607) 257-1111

Bob Dean, Inc.
15 Myers Corners Road
Hollowbrook Park, Suite 1D
Wappingers Falls, NY 12590
Telephone: (914) 297-6406

Tech-Trek Limited
1015 Matheson Blvd., Unit 6
Mississauga, Ontario
Canada L4W 3A4
Telephone: (416) 238-0366

Tech-Trek Limited
2271 Guenette Street
St. Laurent, Quebec
Canada H4R 2E9
Telephone: (514) 337-7540

Tech-Trek Limited
148 Colonade Road, Unit 13
Nepean, Ontario
Canada K2E 7R4
Telephone: (613) 225-5161

Southeast Region
Jack Homan
AVX Corporation
A Kyocera Group Company
3900 Electronics Drive
Raleigh, NC 27604
Telephone: (919) 878-6357
FAX: 919-878-6462

Beacon Electronics
5881 Glenridge Drive, Suite 230
Atlanta, GA 30328
Telephone: (404) 256-9640

Beacon Electronics
7501 Memorial Pkwy. S., Suite 105
Huntsville, Al. 35802
Telephone: (205) 881-5031

Beacon Electronics
6401 Congress Ave., Suite 245
Boca Raton, FL 33487
Telephone: (407) 997-5740

Beacon Electronics
2700 Wycliff Road, Suite 204
Raleigh, NC 27607
Telephone: (919) 787-0330

Beacon Electronics
5501 Deering Place
Greensboro, NC 27406
Telephone: (919) 674-0348

Beacon Electronics
108 Oak Grove Lake Rd.
Greenville, SC 29615
Telephone: (803) 297-7830

C-Tech
4205 Pleasant Valley Rd., Suite 233
Raleigh, NC 27612
Telephone: (919) 782-8100

Dyne-A-Mark Corporation
1001 NW 62nd Street, Suite 108
Ft. Lauderdale, FL 33309
Telephone: (305) 771-6501

Dyne-A-Mark Corporation
101 Sunnytown Rd, Suite 110
Casselberry, FL 32707
Telephone: (407) 831-2822

Dyne-A-Mark Corporation
742 Penguin Avenue, NE
Palm Bay, FL 32905
Telephone: (407) 725-7470

North Central Region
Tom Konicek
AVX Corporation
A Kyocera Group Company
3091 E. 98th Street, Suite 180
Indianapolis, IN 46280
Telephone: (317) 848-7153
FAX: 317-844-9314

Frank J. Campisano Co.
6561 Harrison Avenue
Cincinnati, OH 45247
Telephone: (513) 574-7111

Frank J. Campisano Co.
6415 Castleway West Drive
Indianapolis, IN 46250
Telephone: (317) 577-0319

Frank J. Campisano Co.
6325 Crofton Drive
Ft. Wayne, IN 46835
Telephone: (219) 486-6443

Frank J. Campisano Co.
R.D. #5, 11 Airlane Drive
Coraopolis, PA 15108
Telephone: (412) 264-5151

Frank J. Campisano Co.
7934 Trellage Ct.
Powell, OH 43065
Telephone: (614) 791-9546

Frank J. Campisano Co.
7541 Mentor Ave, #105
Mentor, OH 44060
Telephone: (216) 975-9300

M. Gottlieb Assoc., Inc.
6009 N. Milwaukee Avenue
Chicago, IL 60646
Telephone: (312) 775-1151

M. Gottlieb Assoc., Inc.

M. Gottlieb Assoc., Inc.
608 East Boulevard
Kokomo, IN 46902
Telephone: (317) 455-0444

M. Gottlieb Assoc., Inc.
4444 W. Bristol Road
Flint, MI 48507
Telephone: (313) 732-3922

M. Gottlieb Assoc., Inc.
21411 Civic Center Drive, Suite 309
Southfield, MI 48076
Telephone: (313) 358-4151

Janus, Inc.
650 E. Devon Avenue
Itasca, IL 60143
Telephone: (708) 250-9650

Janus, Inc.
West 239 North 1690
Busse Road
Waukesha, WI 53188
Telephone: (414) 542-7575

R. F. Welch Company
3349 Southgate Court SW, Ste. 108
Cedar Rapids, IA 52404
Telephone: (319) 362-6824

Western Area Manager
John Beach
AVX Corporation
A Kyocera Group Company
2680 North First St., Suite 201
San Jose, CA 95134
Telephone: (408) 432-8966
FAX: 408-432-8942

Mid West Region
Cliff Nehlsen
AVX Corporation
A Kyocera Group Company
2680 North First St., Suite 201
San Jose, CA 95134
Telephone: (408) 432-8966
FAX: 408-432-8942

Peninsula Technical Sales
1101 San Antonio Rd., Suite 205
Mountain View, CA 94043
Telephone: (415) 965-3636

Quadrep, Inc.
2635 North First Street, Suite 116
San Jose, CA 95134
Telephone: (408) 432-3300

Thorson Rocky Mountain, Inc.
384 Inverness Drive S., Suite 201
Englewood, CO 80112
Telephone: (303) 799-3435

Thorson Rocky Mountain, Inc.
1831 East Fort Union Blvd.
Salt Lake City, UT 84121
Telephone: (801) 942-1683

Northwest Region
Steve Adams
AVX Corporation
A Kyocera Group Company
5701 E. 4th Plain Blvd.
Vancouver, WA 98661
Telephone: (206) 696-2840
FAX: 208-695-5836

Tech-Trek Limited
Suite 220-2268 #5 Road
Richmond, British Columbia
Canada V6X 2T1
Telephone: (604) 276-8735

Tech-Trek Limited
375 Scenic Glen Place
Calgary, Alberta
Canada T3L 1J5
Telephone: (403) 241-1719

Western Technical Sales
13400 Northup Way, Suite 14
Bellevue, WA 98005
Telephone: (206) 641-3900

Western Technical Sales
6800 SW 105th, #200
Beaverton, OR 97005
Telephone: (503) 644-8860

Western Technical Sales
E. 12045 Main St., Suite 1
Spokane, WA 99206
Telephone: (509) 922-7600

Southwest Region
Lou Ravtar
AVX Corporation
A Kyocera Group Company
315 Arden Avenue, Suite 28
Glendale, CA 91203
Telephone: (818) 246-6202
FAX: 818-246-0284

Interstate Marketing Assoc.
21044 Ventura Blvd.
Woodland Hills, CA 91365
Telephone: (818) 883-7606

Interstate Marketing Assoc.
7601 E. Catalina Dr.
Scottsdale, AZ 85251
Telephone: (602) 244-9050

Interstate Marketing Assoc.
9225 Dowdy Drive, Unit #216
San Diego, CA 92126
Telephone: (619) 693-3220

Thorson Desert States, Inc.
5801 Osuna Rd. NE, Suite 108
Albuquerque, NM 87109
Telephone: (505) 883-4343

South Central Region
Matt Vogel
AVX Corporation
A Kyocera Group Company
1701 Greenville Avenue, Suite 901
Richardson, TX 75081
Telephone: (214) 669-1223
FAX: 214-669-2090

Ammon & Rizos
901 Waterfall Way, Suite 701
Richardson, TX 75080
Telephone: (214) 644-5591

Ammon & Rizos
7801 N. Lamar, Suite D-73
Austin, TX 78752
Telephone: (512) 454-5131

Ammon & Rizos
2121 S. Columbia, Suite 430
Tulsa, OK 74114
Telephone: (918) 749-6116

Ammon & Rizos
3300 Chimney Rock, Suite 202
Houston, Tx 77056
Telephone: (713) 781-6240

Beneke & McCaul
13460 W. 105 Terrace
Overland Park, KS 66215
Telephone: (816) 765 2998

Beneke & McCaul
19915 Country View Drive
Spring Hill, KS 66083
Telephone: (816) 765-2998

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AVX CORPORATION
A KYOCERA GROUP COMPANY

Myrtle Beach, SC 29577 Tel: 803-448-9411 FAX: 803-626-5292